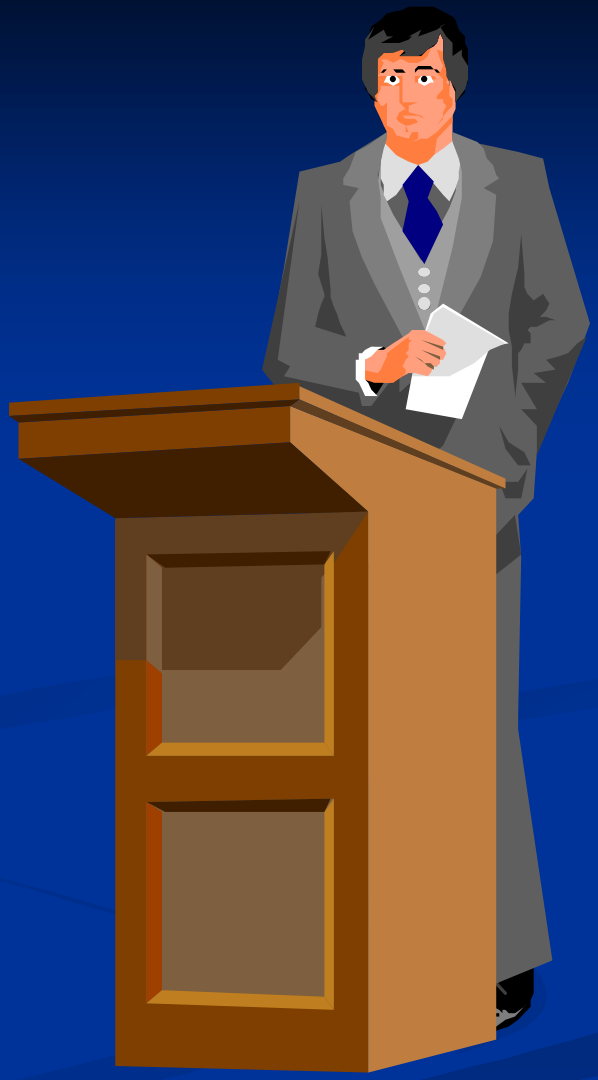
Teaching Math with MyMathLab

Jimmy Fung
Department of Mathematics
HKUST

TRADITIONAL INSTRUCTION

tutorials



Lectures

What's wrong with the tutorial?

- Treats all students as if they are the same
- Ineffective in engaging students
- Inadequate individual assistance
- Poor attendance and success rates

Redesign Characteristics

- Emphasize active learning rather than passive note-taking
- Promote greater student engagement with the material and with one another
- Replace presentations with interactive software used independently
- Provide 24 hr x 7 days access to online learning resources
- Automate grading of homework and quizzes
- Use course management software to monitor student performance

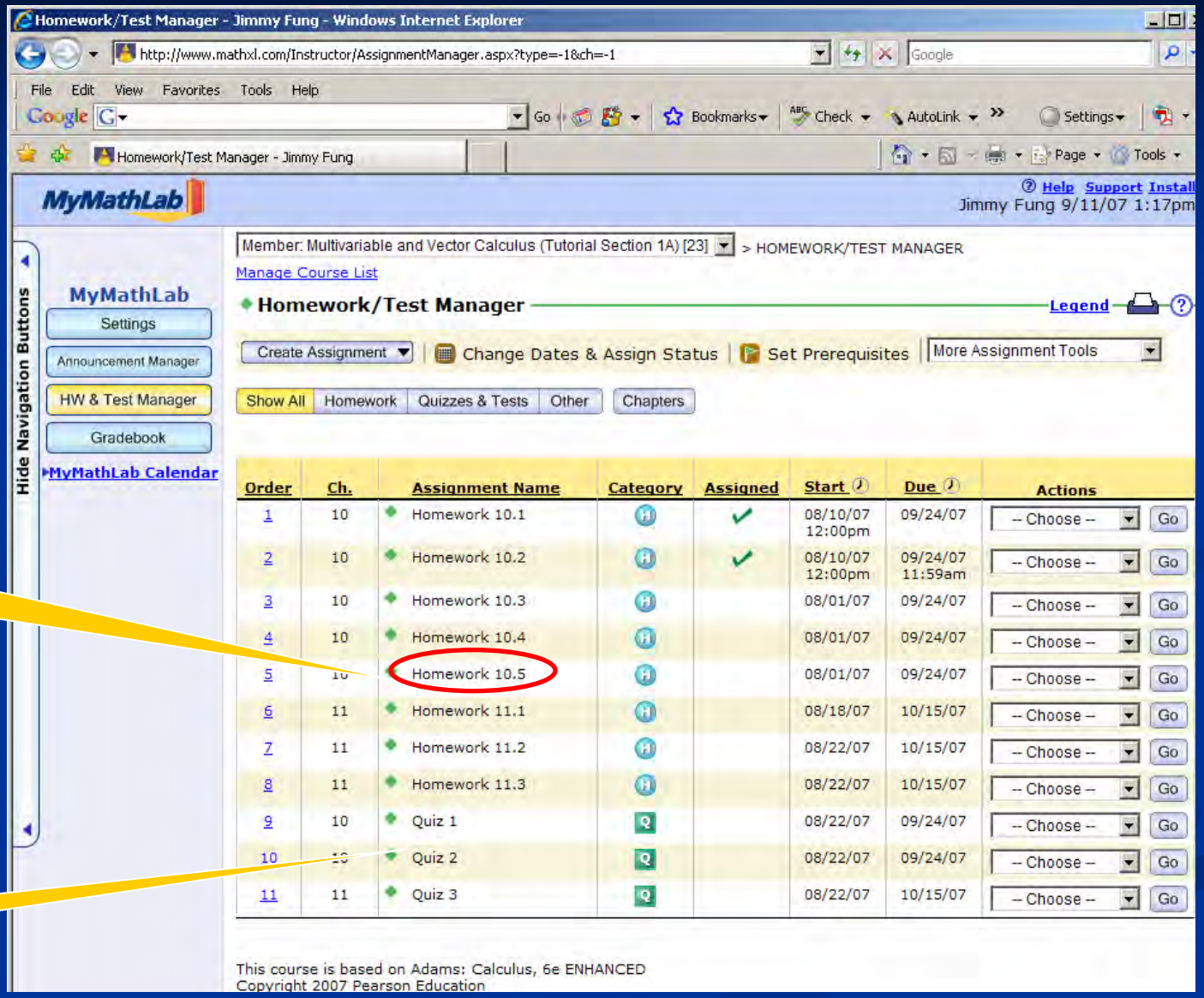
Improving the Quality of Student Learning

For students,

- **MyMathLab** provides dependable and easy-to-use online testing, homework, individualized study plans, along with various instructional multimedia and a full online textbook to help students be more successful in math.

For instructors,

- **MyMathLab** automatically grades online homework assignments and tests, tracking all student results, so you can spend less time grading and more time teaching.
- Instructors can easily monitor students' results, and quickly assess how individual students -- or the class as a whole – are progressing with **specific topics**.



Homework assignment

Quizzes

Switch between exercises

Enter answer

Participate in solving an example step-by-step

See an example worked out for you

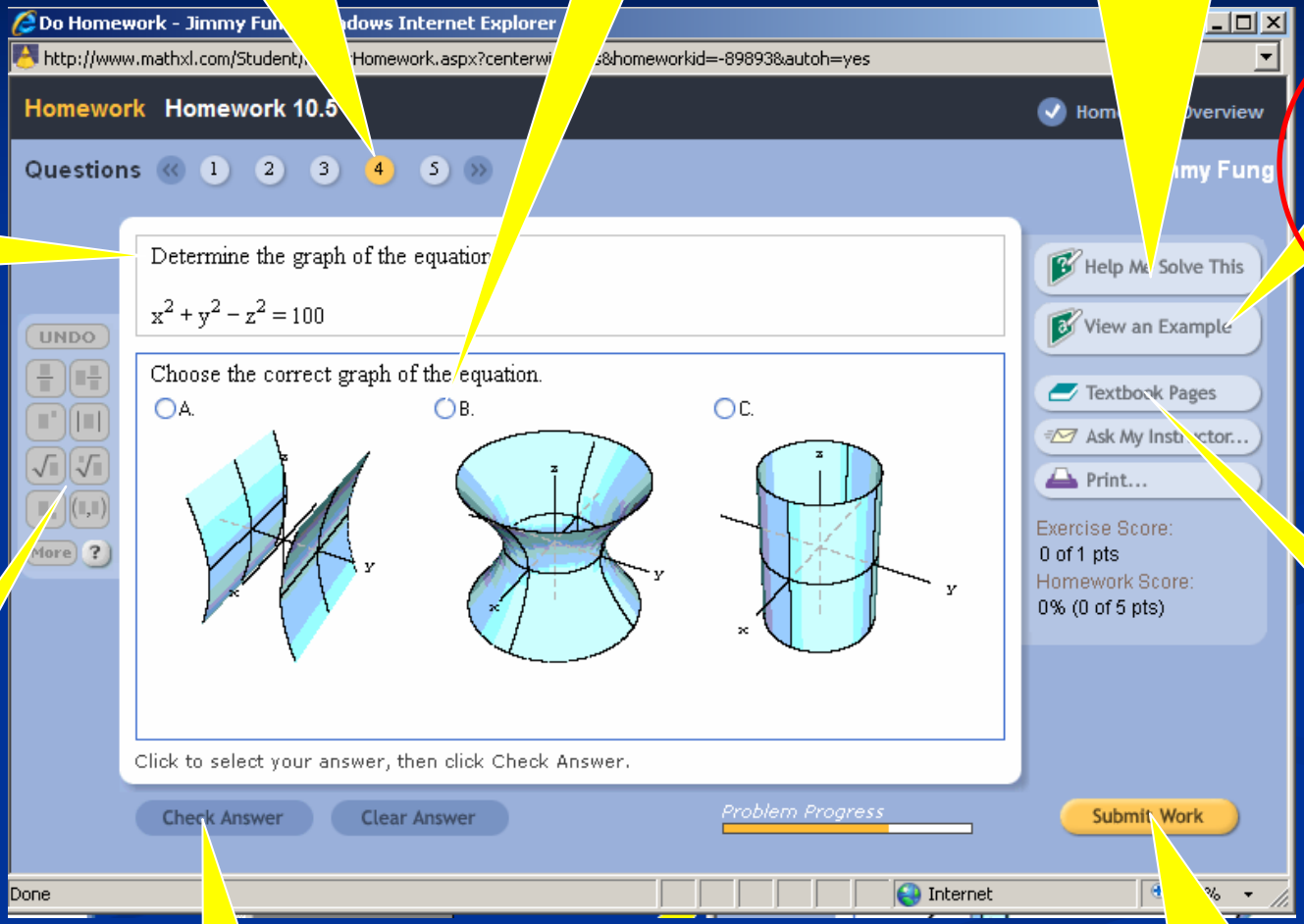
Problem statement

Enter Math syntax

Relevant pages in the textbook

Check your answer

Submit your assignment



View an example

Similar problem

Determine the graph of the equation.

$x^2 - 81y^2 = 1$

Second-degree equations in two variables are cylinders. A cylinder is a surface that is generated by moving a straight line along a generating curve while holding the line parallel to a given fixed line.

Guild you through the problem step by step

Click Continue to see more.

Continue Done

Problem Progress

View an example

Determine the graph of the equation.

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Second-degree equations in two variables are cylinders. A cylinder is a surface that is generated by moving a straight line along a generating curve while holding the line parallel to a given fixed line.

Find the fixed line. Note that the equation $x^2 - 81y^2 = 1$ does not depend on z. Therefore, it holds true when $-\infty < z < \infty$

Second step

Click Continue to see more.

Continue Done

Problem Progress

Determine the graph of the equation.

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Since the equation $x^2 - 81y^2 = 1$ holds true for all possible values of z, the z-axis is parallel to all of the lines along the generating curve.

Click Continue to see more.

Continue Done

Problem Progress

View an example

Second step

Third step

View an example

Determine the graph of the equation.

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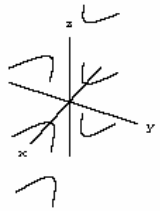
Second step

Since the equation $x^2 - 81y^2 = 1$ holds true for all possible values of z, the z-axis is parallel to all of the lines along the generating curve.

Third step

Consider the cases where z equals -1, 0, and 1 to find the cross-sections of the graph parallel to the xy-plane. The graph for the cross-sections of $x^2 - 81y^2 = 1$ when $z = -1$, $z = 0$, and $z = 1$ is shown below.



Fourth step

Click Continue to see more.

Continue Done

Problem Progress

Determine the graph of the equation.

$x^2 - 81y^2 = 1$

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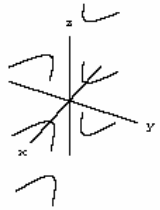
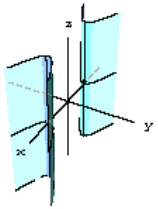


After combining the cross-sections, the following graph is obtained.



The exercise is complete.

Done

Problem Progress

View an example

Second step

Third step

Fourth step

Final step

Switch between exercises

Enter answer

Participate in solving an example step-by-step

Problem statement

See an example worked out for you

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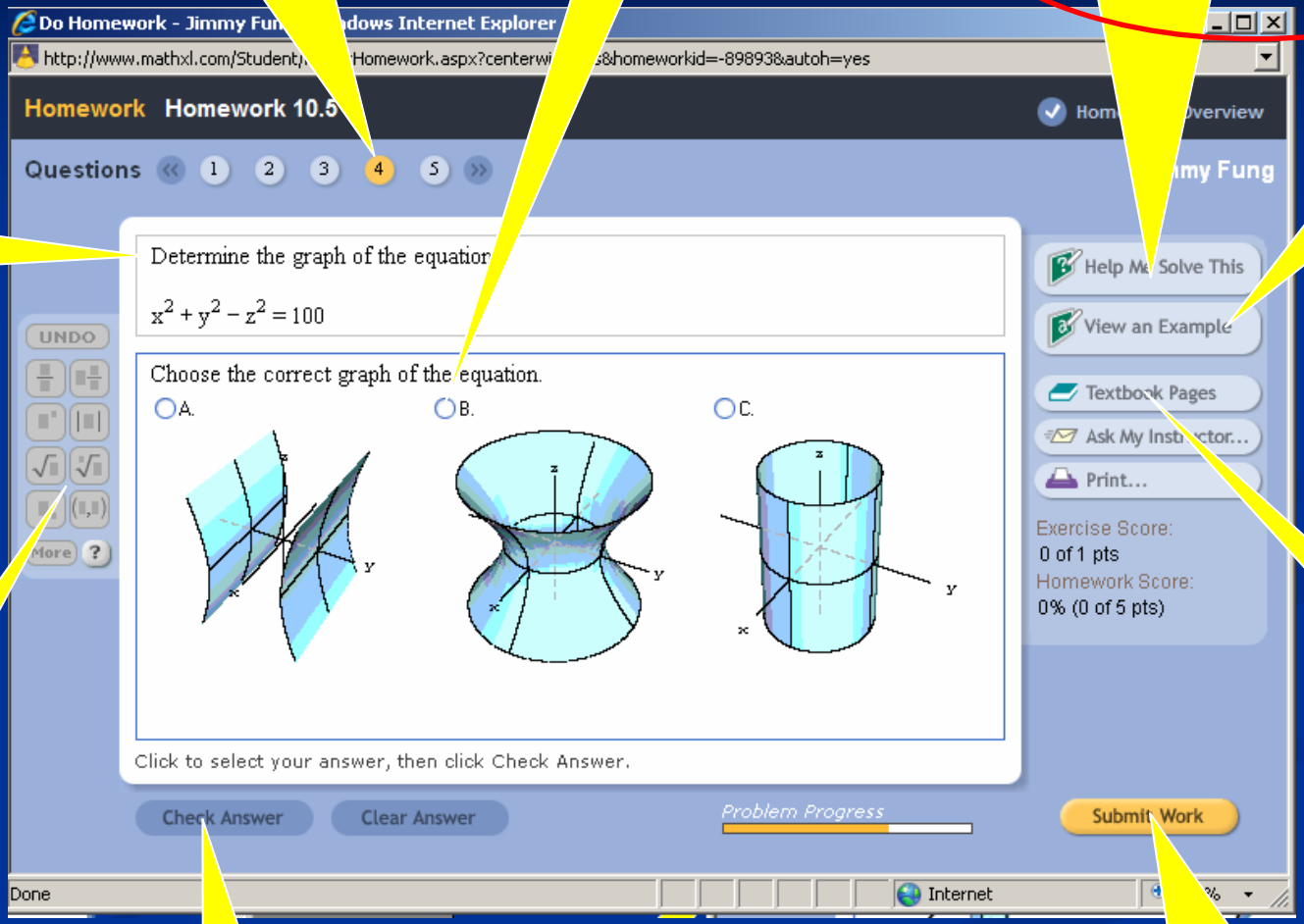
Check your answer

Submit your assignment



Determine the graph of the equation.

$x^2 + y^2 - z^2 = 9$

Second-degree equations in x, y, and z are called quadric surfaces. Examples of quadric surfaces include cylinders, ellipsoids, paraboloids, cones, and hyperboloids.

Use cross-sections to identify the correct graph of the equation $x^2 + y^2 - z^2 = 9$. To find the cross-section on the yz-plane, set x equal to 0 and solve for z.

$(0)^2 + y^2 - 9 = z^2$

$z = \pm$ [ ]

(Simplify your answer.)

Enter any number or expression in the blue-outlined box, then click Check Answer.

UNDO

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Homework Homework 10.5

Homework Overview

Questions « 1 2 3 4 5 »

Jimmy Fung

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$(0)^2 + y^2 - 9 = z^2$

$z = \pm \sqrt{y^2 - 9}$

(Simplify your answer.)

Enter any number or expression in the blue-outlined box, then click Check Answer.

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Homework Homework 10.5 — Homework Overview

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Use cross-sections to ide… …$x^2 + y^2 - z^2 = 9$. To find the cross-section on the …

$(0)^2 + y^2 - 9 = z^2$

$z = \pm \sqrt{y}$

(Simplify your answer.)

Fantastic!

OK

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Homework Overview

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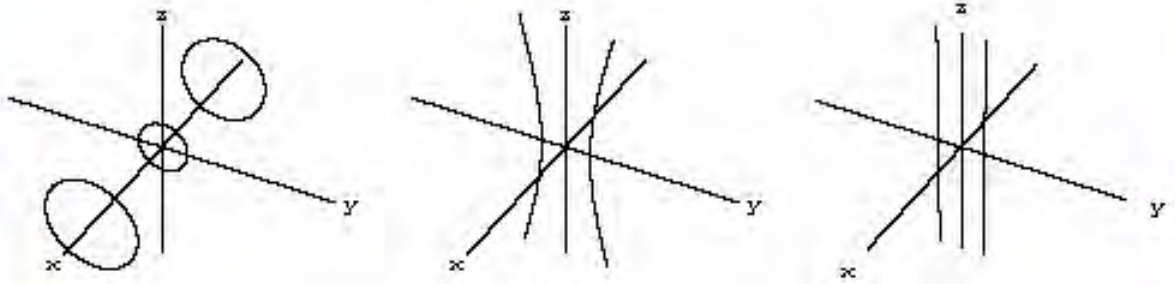
Choose the correct graph of the cross-section $z = \pm\sqrt{y^2 - 9}$.

A. B. C.



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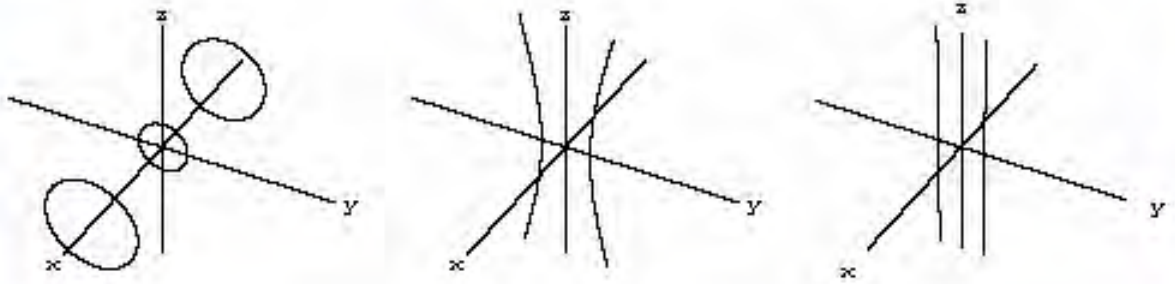

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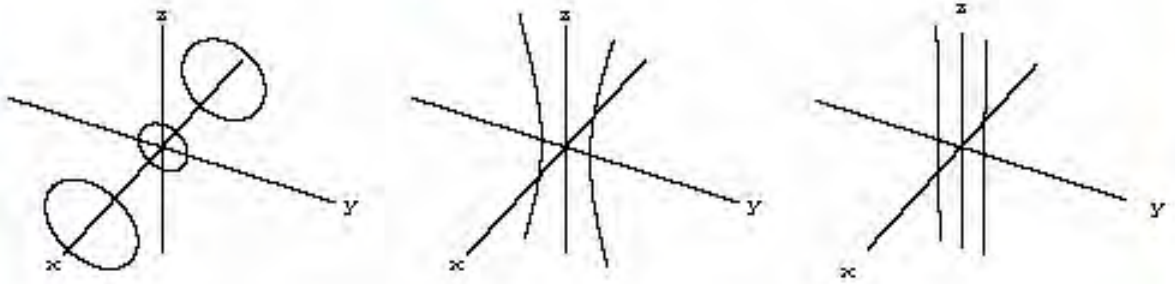

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Questions « 1 2 3 4 5 » Jimmy Fung

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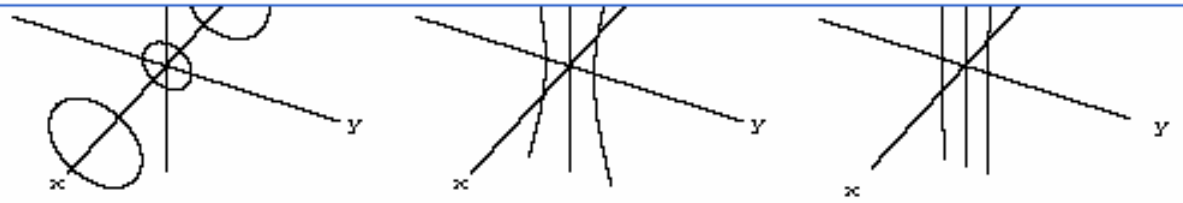

Next find the cross-section on the xz-plane. Set y equal to 0 in the equation $x^2 + y^2 - z^2 = 9$ and solve for z.

$x^2 + (0)^2 - 9 = z^2$

$z = \pm \sqrt{x^2 - 9}$

(Simplify your answer.)

Enter any number or expression in the blue-outlined box, then click Check Answer.

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Questions 1 2 3 4 5

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(Simplify your answer.)

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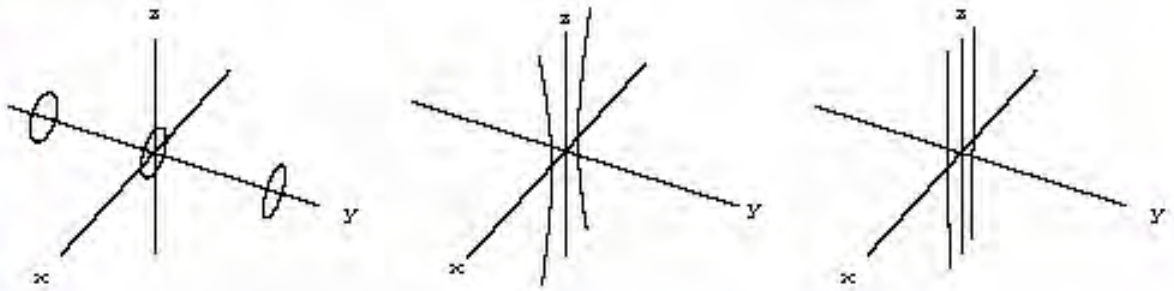
A. B. C.



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Determine the graph of the equation.

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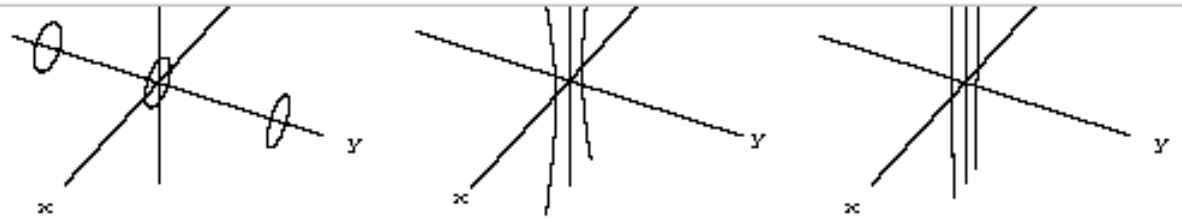

Now find the cross-sections on the xy-plane or parallel to the xy-plane. Set z equal to 0 in the equation $x^2 + y^2 - z^2 = 9$ to obtain the equation $x^2 + y^2 = 9$.

Also, notice that the equation $x^2 + y^2 - z^2 = 9$ is in the form $x^2 + y^2 - z^2 = 3^2$. One other cross-section of interest is the cross-section parallel to the xy-plane when z equals ± 3. If $z = \pm 3$, $x^2 + y^2 = 18$.

Click Continue to see more.

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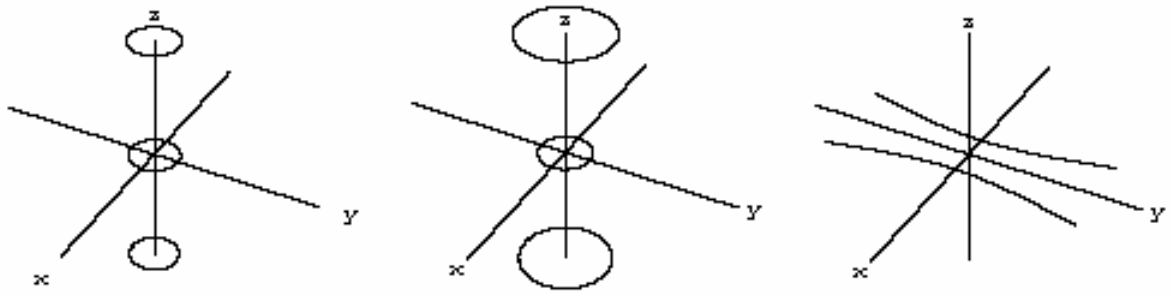
Determine the graph of the equation.

$x^2 + y^2 - z^2 = 9$

Choose the correct graph of the cross-sections $x^2 + y^2 = 18$ when $z = \pm 3$ and of $x^2 + y^2 = 9$ when $z = 0$.

A. B. C.



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Homework Homework 10.5

Homework Overview

Questions « 1 2 3 4 5 »

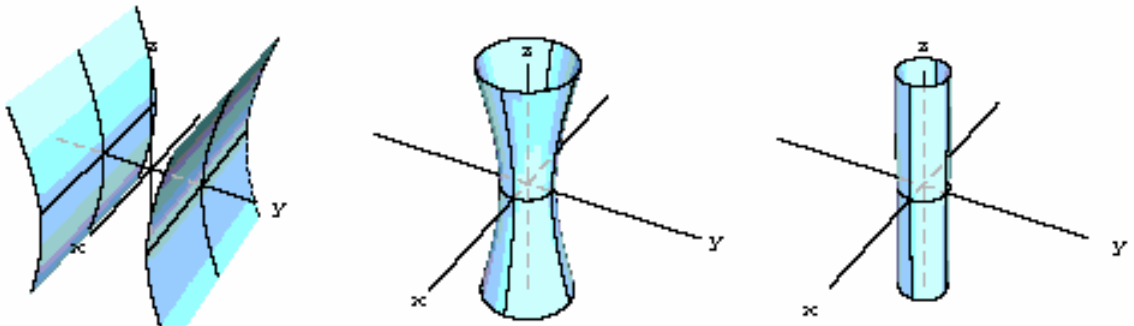
Jimmy Fung

Determine the graph of the equation.

$x^2 + y^2 - z^2 = 9$

Combining the cross-sections, choose the correct graph of the equation.

A. B. C.



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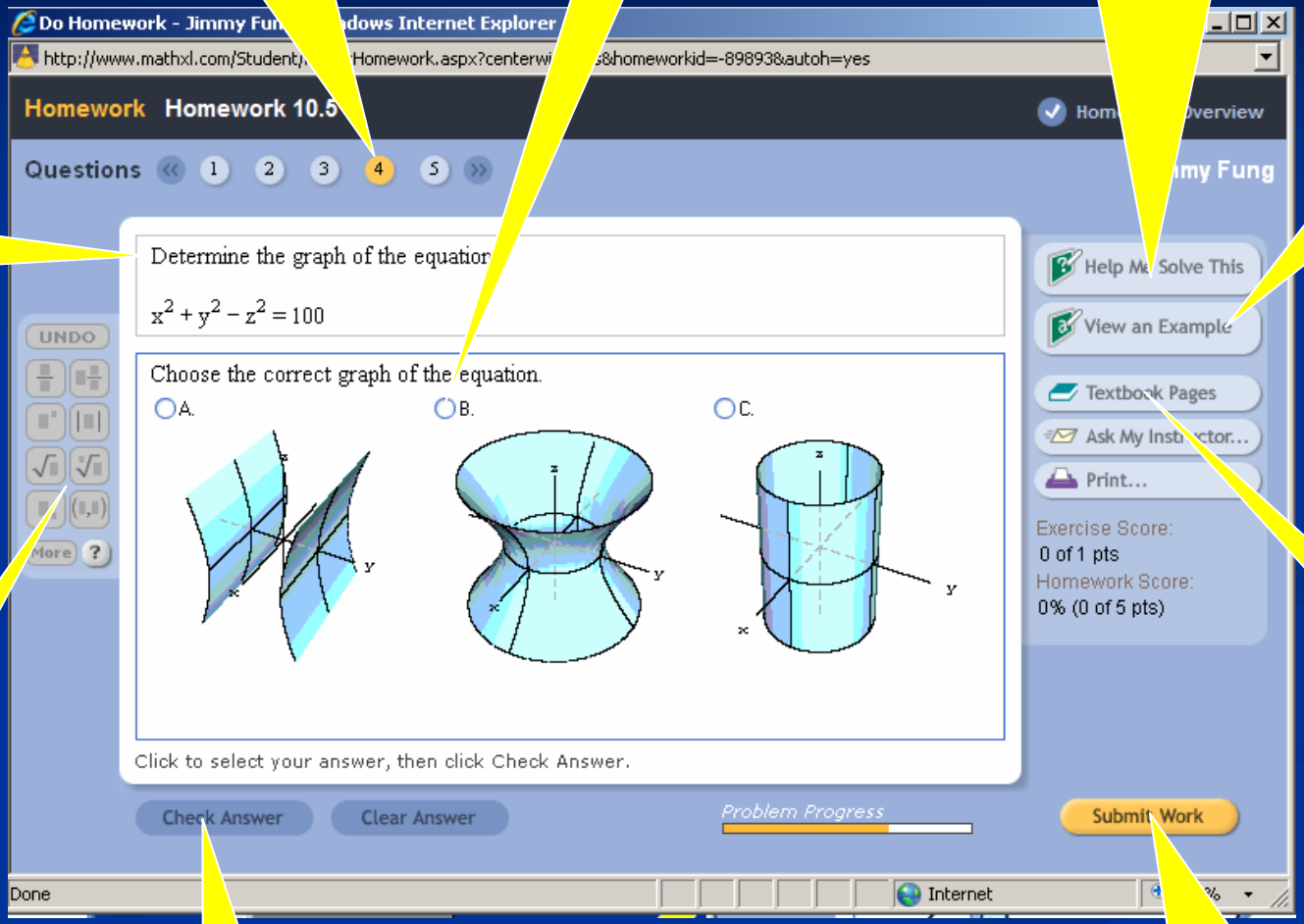

10.5 Quadric Surfaces

The most general second-degree equation in three variables is

$$Ax^2 + By^2 + Cz^2 + Dxy + Exz + Fyz + Gx + Hy + Iz = J.$$

We will not attempt the (rather difficult) task of classifying all the surfaces that can be represented by such an equation, but will examine some interesting special cases. Let us observe at the outset that if the above equation can be factored in the form

$$(A_1x + B_1y + C_1z - D_1)(A_2x + B_2y + C_2z - D_2) = 0,$$

then the graph is, in fact, a pair of planes,

$$A_1x + B_1y + C_1z = D_1 \quad \text{and} \quad A_2x + B_2y + C_2z = D_2,$$

or one plane if the two linear equations represent the same plane. This is considered a degenerate case. Where such factorization is not possible, the surface (called a **quadric surface**) will not be flat, although there may still be straight lines that lie on the surface. Nondegenerate quadric surfaces fall into the following six categories.

Spheres. The equation $x^2 + y^2 + z^2 = a^2$ represents a sphere of radius a centred at the origin. More generally,

$$(x - x_0)^2 + (y - y_0)^2 + (z - z_0)^2 = a^2$$

represents a sphere of radius a centred at the point (x_0, y_0, z_0). If a quadratic equation in x, y, and z has equal coefficients for the x^2, y^2, and z^2 terms and has no other second-degree terms, then it will represent, if any surface at all, a sphere. The centre can be found by completing the squares as for circles in the plane.

Math Department Computer Lab

Active learning

- Provide students with **individualized** assistance

More discussion during tutorials

Experience with MyMathLab

- What we love about MML
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  - Instant feedback for students
  - No more hours of grading
  - Ability to customize course and to customize exercises

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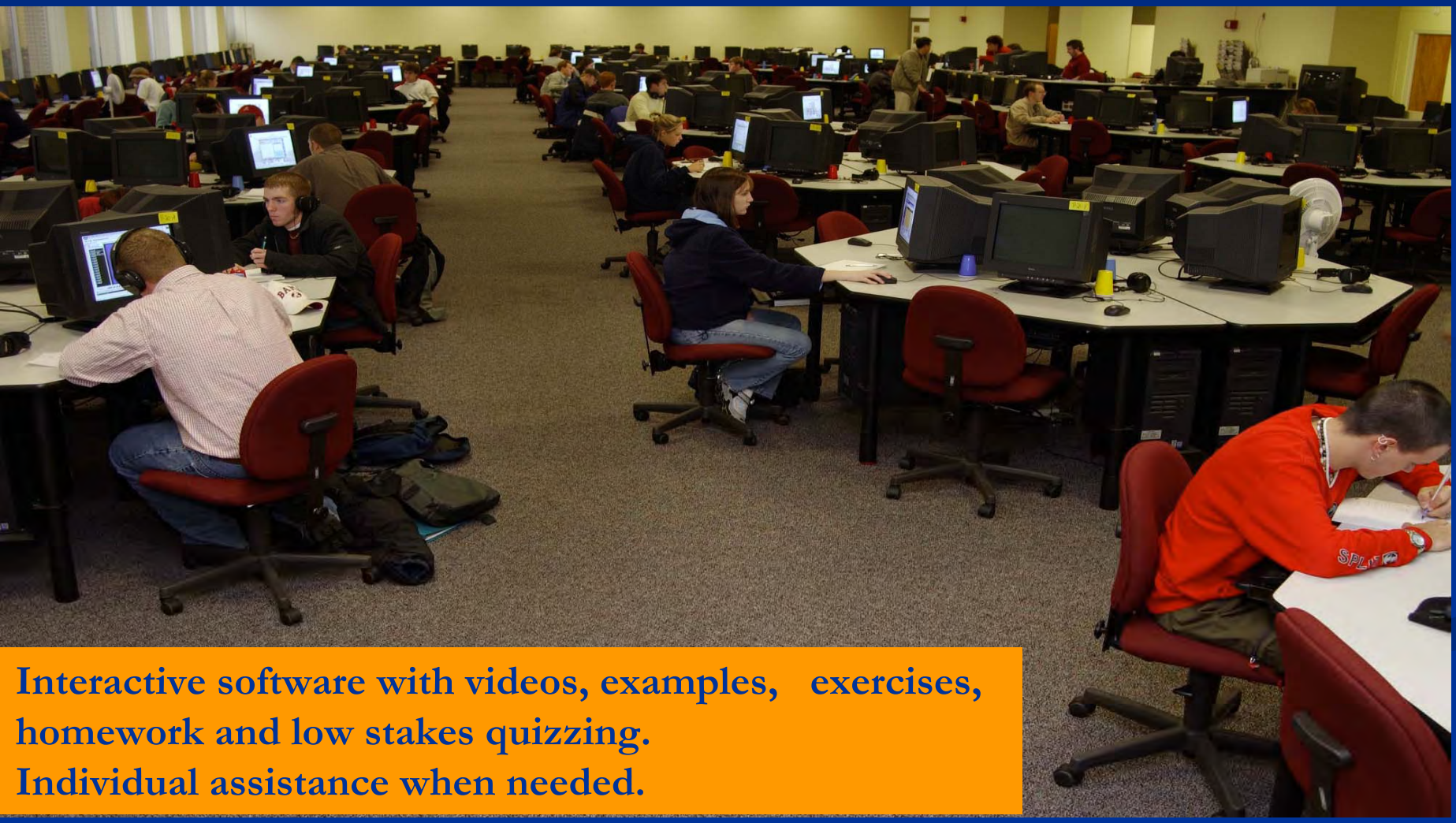

Interactive software with videos, examples, exercises, homework and low stakes quizzing.
Individual assistance when needed.